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AUTHOR	Landers, Alynne
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ABSTRACT

This fact sheet on alternative athletic equipment for cycling identifies the different types and manufacturers of adapted cycles with two, three, or four wheels and cycling accessories available for persons with disabilities. It describes modified leg-powered cycles, hand cycles, tandem cycles and discusses cycle features such as rider position, wheel configuration, and power input. Cycle accessories described include pedal attachments, torso supports, back supports, hip pads and harnesses, modified seats and seat accessories, adapted handlebars and handlebar accessories, and protective helmets. A table lists approximately 50 cycles and provides the following information for each: model name, manufacturer, power input, wheel configuration, rider position, user groups, and comments. Manufacturers' addresses are provided. The fact sheet concludes with a list of 6 sports organizations for persons with disabilities, 6 general cycling associations, 11 sports publications of interest to athletes with disabilities, and 22 recommended additional readings. (JDD)

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NARIC AND ABLEDATA
Serving the Nation's Disability Community

ABLEDATA Database of Assistive Technology

Adaptive Sports and Recreation Equipment

Cycling

ABLEDATA Fact Sheet Number 19 August 1993

Introduction

Use a cycle to get around or tool around, race or relax!

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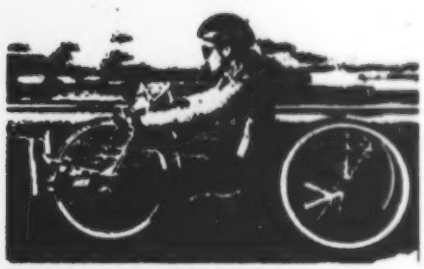
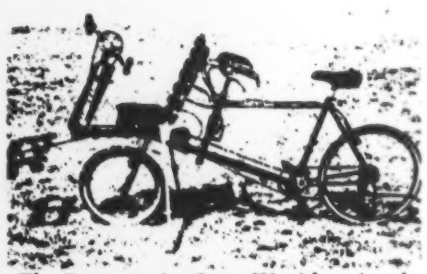
Just as individuals come in all different shapes and sizes with various abilities, cycles are available in a range of shapes and sizes suited for each individual! Cycles come with one, two, three, and four wheels. Some require a bent-over rider position, some allow leaning back in a recumbent position. Some cycles are hand powered; some are leg powered. Some cycles, the tandem cycles, allow two or more friends to cycle together, and one tandem even allows the front rider to read while cycling! Bikes and trikes are made for the beach or the mountains, and all terrains in between.

Regardless of age, both able-bodied individuals and persons with physical, sensory, or cognitive disabilities can use cycles to get around or just tool around, to race or simply recreate! This fact sheet is the third in a series on alternative athletic equipment, and will identify the different types and manufacturers of adapted cycles and cycling accessories available for persons with disabilities, cycling organizations, and related resources.

Types of cycles



David Cornelsen aboard the Freedom Ryder by Brike International



The Counterpoint Opus IV with optional handcrank by Anglelake Cyclery

Modified Leg-Powered Cycles. With the appropriate accessories, persons with various disabilities can adapt commercially available leg-powered bicycles and tricycles of any make. These accessories, described in detail in the following section, can be used to adapt cycles for various physical limitations. For persons with poor balance or trunk control there are supports, belts, and wide bench-style seats. Adapted hand brakes and gear shifting mechanisms can be employed by individuals with the use of one arm. People with limited hand grip or strength can use hand and wrist straps connected to the handlebars, or vertical hand grips, to help them maintain contact with the cycle's steering components. An adult three-wheeled cycle may be an alternative to the traditional bicycle for persons with poor balance but otherwise good leg strength and trunk control.

Hand Cycles. Hand-powered cycles have made cycling accessible to individuals of all ages who have either lost the use of one or both legs, or who do not have the leg strength to use traditional cycles. Hand-powered cycles are available in numerous designs with various features that allow cycle propulsion by pedaling with the arms or by using the arms to push and pull a handlebar lever. For the competitive, hand cycles are a great means of cardiovascular exercise and cross-training for various wheelchair sports. For all, hand cycles are a recreational means of alternative outdoor mobility.

Tandem Cycles. Tandem cycles are designed to carry two or more cyclists, with each cyclist contributing to the cycle's propulsion. Most tandem cycles are exclusively leg powered, but a few, such as the Counterpoint Opus IV with optional handcrank set, allow one cyclist to use leg power and the second cyclist to use hand power. Tandems come in bicycle-style models with two or more wheels configured in a line, and in tricycle-style three-wheel models. Tandem cycles are especially appropriate for blind and low vision individuals since they may benefit from the exercise of cycling, regardless of their visual limitations, when coupled with a sighted navigator to steer the bike. Tandem cycles also offer individuals with poor balance the opportunity to cycle due to the stabilizing effect of another rider.

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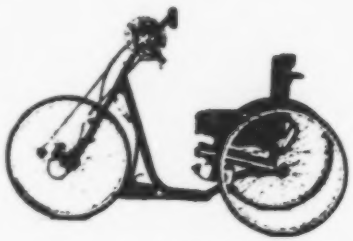
Cycle features

The following are brief descriptions of cycle features that may apply to any kind of cycle, and explanations of the classifications used in the product grids on the following pages.

Rider Position. In this fact sheet, rider positions for all cycles have been categorized into three classifications: recumbent, chair, and racing. Recumbent-style bikes and trikes allow the rider to sit in a semi-reclining position with legs extended. The rider's torso may be positioned from just past upright to a recline of approximately 45 degrees, allowing use of the backrest of the seat to give maximum propulsion energy to either the arms or legs. The legs may rest in a number of positions including between two front wheels, on either side of a single front wheel or hand crank shaft, on foot pedals, and, in some cases, above the front wheel. For high level spinal cord injuries and others with limited abdominal strength, the use of a recumbent-style cycle may alleviate the need for a chest belt which keeps the body from being pulled towards the handcrank tower during cranking. Recumbent-style hand cycles are recommended over the chair-style models for speed cycling due to their lower center of gravity and subsequently increased stability at high speeds. Taking a turn at high velocity in a chair-style cycle could result in the cycle tipping over. The chair-style cycle designs position the rider's thighs, calves, and upper body more or less at right angles to one another, as in sitting in a chair. The torso is upright or only slightly angled forward. The seat height will generally be higher on chair-style cycles than on the recumbent-style cycles, providing for increased visibility of the cycle by motorists. These cycle models are generally built for recreational riding at slow to moderate speeds on even terrain. Feet may rest on foot pedals or on a platform either slightly under or in front of the seat. The racing cycle places the rider's body in a slightly crouched position with the legs in a kneeling position (tucked under the seat) or able to extend straight down to the foot pedals. This rider position is the opposite of the recumbent position with regards to weight distribution, and is almost exclusively found on leg-powered cycles. The racing position requires an individual to have sufficient arm strength to support the weight of the upper body as it leans towards or over the handlebars.



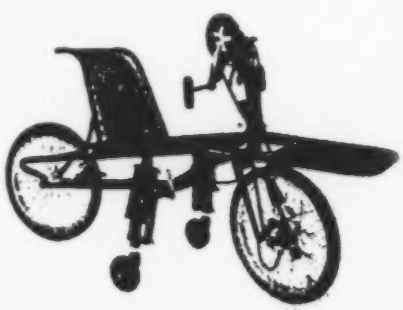
The MACH 3 by Quickie Designs/Shadow Products is a chair-style hand cycle.

Wheel Configuration. No less variable than frame structure is the number and configuration of wheels. Of course, the bicycle, by definition, only has **two wheels**, and their configuration is established. The HandBike™ is a hand-propelled cycle by New Dimensions Design that features two folding caster wheels situated directly under the rider's seat. These additional two wheels can be lowered and locked to add stability when stopped, cycling at low speeds, or for indoor use. However, **three-wheeled** cycles provide for a number of wheel combinations. The traditional child's tricycle design of two wheels in the rear and one in the front has been transferred to the design of some adult three-wheelers. But even these "1 front, 2 rear" cycles differ because of the individual wheel sizes. Some have equally sized wheels, others have a larger front tire and either smaller or caster-type wheels in the rear, and still others have larger back tires. Three-wheelers also come in "2 front, 1 rear" wheel configurations. With this configuration, the rider's legs are generally positioned between the front wheels either on a platform or bar, straddling the crank shaft. Wheel sizes may vary in the same manner as "1 front, 2 rear" configurations. Four-wheel cycles, too, may have the wheels placed in different areas. The most common **four-wheel** configuration consists of two front and two rear wheels.

The Haverich 27" Racing Tricycle

Power Input. For purposes of the grid, the entries under this category specify if the cycle is hand or leg powered. Leg-powered cycles feature pedaling action only. However, persons with disabilities who wish to use a leg-powered cycle may want to focus attention on the cycle's gearing features since additional gears may enable persons with limited leg strength to ride up steeper inclines.

Hand-powered cycles have more variation in their propulsion action than leg-powered cycles. Depending on the individual's upper body strength and manual dexterity, any one of three hand-powered input techniques may be used. The majority of hand-powered cycles on the market are powered by a pedal action,



The HandBike by New Dimensions Design is a recumbent-style four-wheel hand cycle.

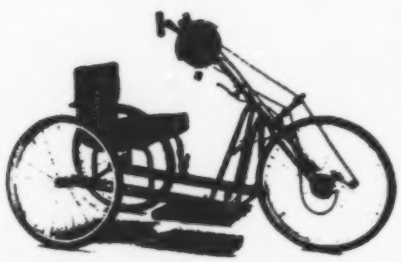
Reciprocal *handcrank pedals*

Parallel *handcrank pedals*

that is, a hand-operated pedal crank attached to a chain drive or directly to the front wheel. Pedal action may be either parallel or reciprocal. *Parallel* refers to pedal action propulsion achieved by simultaneously rotating two parallel handlebars, almost in a rowing action. *Reciprocal* is the action that directly simulates leg pedaling; each hand cranks in opposition to the other. According to David Cornelsen, a leading hand cyclist and world arm-powered record holder of the transcontinental "Ride Across America," a parallel pedal action is advantageous for high speed cycling because of increased stability (a reciprocal pedal action can cause wobbling) and more efficient muscle use (isometric movement of both arms emphasizing the lats, or back muscles, and biceps rather than the pectorals). Most pedal-action propelled cycles require arm movements away from the body, whether the action is parallel or reciprocal. A few hand-crank cycles, however, provide the option of pedaling towards or away from the rider's body while still maintaining forward motion of the cycle.

Another means of power input to propel a hand cycle is the push-pull action, achieved by pushing and then pulling on a horizontal handlebar connected to either a chain drive or directly to the wheels.

Other Features. In addition to the features identified in the Cycle Grid, the cycle most suited to an owner's personal and recreational needs will depend on one or more other features. The **type of wheels and tires** will be an especially important feature for persons interested in off-road riding (all terrain or mountain biking), for racing, or for children using a trike indoors. **Adjustability** of the seat or handlebars of a cycle is an important consideration for schools or other institutions looking to purchase cycles to fit various rider groups, or for parents wishing to buy a cycle children can continue to use as they grow. **Brakes** on racing bikes are often not drum brakes due to their increased weight. Instead, alternative braking mechanisms can cut down on the cycles weight and wind resistance when coupled with racing tires. **Ease of assembly/disassembly** should be considered for cyclists or parents wishing to transport their cycles in cars. Along these same lines, **weight** of a cycle, which depends mainly on frame materials and accessories, may also be a consideration. For competitive cyclists, the **number of speeds** available and **gearing mechanisms** are of particular interest. On a more aesthetic note, **color** choice can make the difference between a good cycle and a great cycle! Many manufacturers offer metallic and gradient (gradual blending of two or more colors) frame painting in addition to traditional one-color powdercoats. Manufacturers should be contacted directly for details on these cycle features and other specifications.



The Pro-Cycle by Top End: Available in more than 20 contemporary colors.

Cycle accessories

The traditional cycle consists of either two (bicycle) or three (tricycle) wheels, is powered by the rider's legs, and steered by the rider's hands. Braking may either be accomplished by use of hand brakes or by back pedaling with the legs. For individuals with sufficient leg strength to propel a cycle but who may be lacking in trunk control or balance, there are a number of adapted cycles and accessories to help them ride. Many of these same accessories may also be used with hand cycles. Please note, however, that many of these accessories involve strapping the rider to the cycling equipment. Should the cycle tip over, the rider may not have the opportunity or arm strength to break the fall or to fall clear of the cycle. Appropriate supervision should be given to riders using one or more of these "strap-in" accessories.

Pedal Attachments. Foot pedal attachments are designed to keep the rider's feet on the pedals. The device generally takes the form of a platform, or sandal, that is bolted or otherwise secured to the cycle pedal, and has velcro or buckle straps that go over the rider's foot. Some pedal attachments have a contoured heel loop, a guard that fits around the heel to keep it from slipping backwards. Others have a calf guard, shaped similar to a foot drop splint, or a leg guide. Foot pedal attachments may also be made at home with a cast boot screwed to a piece of cut plywood so that it can be slipped on and off the pedal.[1] Another "Do-It-Yourself" foot pedal consists of a water ski boot fastened to a piece of plywood cut to fit the user's foot.[2]

[1] *Handling, K.A., "Bicycle Pedal Modifications for use in a Physical Therapy Department,"* Journal of Physical Therapy, *Vol 62, No. 7, Jul 1982.*

[2] *Redmond, P.T. "Water Ski Boot to Hold Foot on Bicycle Pedal,"* Journal of Physical Therapy. *Vol. 59, No. 1, Jan 1979.*

A pedal leveling system is another pedal attachment. This system connects the two pedals by means of a string or nylon rope that runs through an eyelet on the cycle frame. By connecting the two pedals, excessive extension and flexion of the rider's feet is prevented, and leg and foot coordination may be improved in some individuals. The system may or may not include sandals. A pedal leveling system may also be used with hand-powered cycle attachments so that the rider's feet and legs move in a pedaling motion although the hands and arms are actually propelling the cycle.

Torso Supports. For individuals with poor balance or marginal trunk control, torso supports may offer them the ability to ride a three-wheeled cycle. Torso supports often have a curved, rigid brace mounted on a metal or wood rod. The rod attaches to the back of the cycle seat or to the frame. The brace usually has some sort of strap or belt that goes completely around the rider's torso in order to secure the body against the brace, thereby maintaining an upright position. Torso supports will also be useful to individuals with limited abdominal strength who wish to use a chair-style handcycle. Most models of trunk supports are adjustable in height and girth.

Back Supports. Torso supports serve the same function as back supports, but back supports do not have the full-body lateral support system that the torso supports do. The back supports, therefore, provide a high backrest for individual's to lean against, but will not prevent the rider from leaning from side to side as the torso supports will. Back supports are typically motorcycle- style high backs with a padded surface. A waist belt may be included with the support.

Hip Pads and Harnesses. Hip pads for lateral waist support, shoulder harnesses, and leg harnesses are other accessories that may be added to a torso or a back support. As of this writing, Haverich Ortho-Sport is the only manufacturer identified that makes these accessories. Haverich should be contacted directly to see if this equipment is compatible for attachment to support systems by other manufacturers.

Modified Seats and Seat Accessories. Danmar Products Inc. manufacturers a cycle seat designed to provide more support than a traditional seat by rotating with the movement of the rider's legs and hips, eliminating friction and abrasion, and by removing the pressure from the crotch area to distribute the rider's weight over a padded surface. This seat, the Rx Rider #5025, consists of a foam-filled suede pad on safety webbing suspended from two pivot points supported by a tubular steel frame mounted onto the cycle frame. Flaghouse also distributes an oversize bench style seat that tilts front to back to conform to the rider's motion. Allyn Air Seat manufacturers an air flotation seat cushion for cycles that can also be used on stationary exercise cycles.

Pommels, or abduction pads, are a type of seat accessory designed to maintain knee abduction (separation) and attach either to the seat itself or the main frame tube of the cycle that the rider straddles.

For individuals with lower body paralysis, the possibility of pressure sores from extended periods of sitting on a completely unpadded or insufficiently padded seat is always present. The majority of the standard seats on the cycles presented in this fact sheet do not have proper pressure relief seats. Many will, however, accommodate a wheelchair seat cushion. Another option for pressure relief during long bike rides may be the use of the Jay Protector™. The Jay Protector™ is a minimally sized fluid/foam cushion for children and adults that straps around the user's legs and waist to stay in place regardless of the user's movements. The Jay Protector is manufacturer recommended for skin protection for periods up to four hours.

Adapted Handlebars and Handlebar Accessories. For many individuals, the traditional horizontally positioned handlebars are difficult to grasp. For this reason, some companies have developed vertical handlebars or handlebar attachments to promote facilitated grip and better arm and back position while cycling.

Hand or wrist straps and arm supports are other types of handlebar accessories that position and support the rider's wrists to keep the hands near the handlebars. The strap hand positioners may be made of hook and loop material

Feats by Hand Cyclists

★

David Cornelsen, named by *Bicycling* magazine as the 1990 Cyclist of the Year, is the world arm-powered record holder of "Ride Across America," finishing on a Freedom Ryder cycle in 18 days, 16 hours, and 52 minutes coast to coast.

★

Doug Wight won the 200-meter arm-powered speed contest at the International Human Powered Vehicle Races on a Varna three-wheel hand cycle, clocking a new world speed record of 30.75 miles per hour.

★

Steve Ackerman climbed passes of up to 12,000 feet on the 443 mile "Ride the Rockies Tour."

★

Joseph Ramos Cypher placed first in his class at the 6th National Triathlon for the Physically Challenged using a Freedom Ryder hand cycle.

★

Scott Seeman, David Cornelsen, Steve Ackerman, and Joe Scott all cycled in the RAGBRAI XX (The *Register's* Annual Great Bicycle Ride Across Iowa), hand pedaling up to 70 miles a day - 294 miles total.

Steve Ackerman in action.

Haverich Orthosport Model 24/20 with footrests and leg guides, backrest, shoulder harness and hip pads.

or leather with buckles. Hand straps may also be used with hand cycles for persons lacking grip strength, but with sufficient arm strength to simulate the cranking motion required for propulsion. Arm supports attach to the hand grips and consist mainly of a small platform on which to rest the forearm.

For riders with the use of only one arm, Therapeutic Recreation Systems (TRS) Inc. distributes a single lever control device designed to fit standard handlebars of racing style bicycles. With this device, a single lever pull operates both the front and rear brakes simultaneously. Haverich Ortho-Sport makes a specialized handlebar accessory for persons with unilateral upper extremity amputation or dysmelia. This optional handlebar system consists of a height-adjustable handlebar with the two handgrips positioned adjacent to the vertical handlebar support with chin-activated directional indicators and horn. The height adjustment of the handlebar positions the switch box high enough so the rider need not bend over excessively.

Haverich Ortho-Sport also manufactures a unique "Auxiliary Handlebar," a curved bar that attaches perpendicularly to the handgrips to provide a balance or steering support equidistant from the body to the handlebar regardless of steering angle.

Protective Helmets. Although it varies on a local level, most states require cyclists over the age of approximately 16 years to wear protective helmets with a hard shell. While protective helmets are essential in preventing up to 90 percent of head injuries caused by cycling accidents for all riders, head gear is especially important for children using one or more strap-in accessories described above. Helmets by manufacturers of adaptive cycling equipment are identified in the Cyclists' Buyer's Guide in this fact sheet, but helmets can also be purchased at local cycle shops and many department stores carrying cycles and cycle accessories.

Other hand cycle equipment

The Saratoga Cycle and optional Cycle Table.

Also available are stationary hand cycles that are mounted on a table top or other flat surface that is the height of the user's chest. By sitting directly in front of the stationary cycle, an individual can hand-cycle in place for exercise, indoor training during inclement weather, or therapeutic range-of-motion activities. The Sinties Scientific Power Trainer P/A has a motor for passive or active cycling exercise using the arms or legs. The Saratoga Cycle offers four handgrip styles, an adjustable forehead rest, and an optional cycle table.

Quickie Designs/Shadow Products manufactures the CYCL-ONE, hand-pedalled attachment that transforms most manual wheelchairs into hand cycles. The attachment fastens to the chair's frame underneath the seat. CYCL-ONE has one spoked front tire connected to the handcrank shaft, which rises to approximately chest height. The attachment is available in three, twelve, and forty-eight speeds propelled in the *parallel* pedal action that is similar to a rowing motion.

Cycling safety

As with all sports equipment and in all recreational activities, safety is of the utmost importance. Protective helmets are recommended for all riders, and required by law for children. Helmet laws vary from county to county; state departments of transportation and local motor vehicle administration offices may be contacted to verify the age limit at which wearing a helmet becomes optional. These organizations also publish pamphlets covering the rights, responsibilities, and restrictions of cyclists using public roads.

Conclusion

"Different spokes for different folks" is an adaptation of an old cliché but one that holds true. In choosing the best cycle, professional expertise from a prosthetist, therapist, or other rehab expert may be helpful. For persons interested in racing hand cycles, expert advice is available from Steve Ackerman at 303/221-4290.

In this fact sheet, many cycles and cycle accessories available to persons with disabilities have been identified, but there are, undoubtedly, more still out there! Additional information is welcomed by the ABLEDATA staff; individuals discovering new cycling equipment should call 800/227-0216 so that these products may be included in updated fact sheet editions

Model/Manufacturer	Power Input	Wheels/ Config.	Rider Position	User Groups	Comments
Mobility Aid Tricycle (MAT) Consumer Care Products Inc.	Leg	3, 1F/2B	Chair	Children	Vertical handlebars with wrist straps, trunk support, seatbelt, and foot harnesses standard.
Foot-Drive Tricycle (PC 4756F) J A Preston	Leg	3, 1F/2B	Chair	Children	Vertical handgrips, abduction wedge, low back support, and hip control belt are standard equipment.
Lo-Boy Trike Anthony Bros. Manufacturing	Leg	3, 1F/2B	Recumbent	Children	Available with or without foot harnesses, seat pad, back support, and pad.
Rifton Tricycle (E12) Rifton Equipment	Leg	3, 1F/2B	Chair	Children	Standard equipment includes back support, vertical and horizontal handgrips, seatbelt, and pedal leveling system.
Small (PC 4744B) & Large (PC 4745B) Adapted Tricycles J A Preston	Leg	3, 1F/2B	Chair	Children	These cycles come with torso support and foot harnesses.
Standard Mobility Trike (6459E) Flaghouse	Leg	3, 1F/2B	Chair	Children	Vertical handlebars with wrist straps, abduction pad and seatbelt standard.
Terrier Tricycle Triaid Inc.	Leg	3, 1F/2B	Chair	Children	Back/trunk support, foot pedal levelling system, vertical handgrips, and abduction pad available.
Rifton Small Chain Tricycle (E14) Rifton Equipment	Leg	3, 1F/2B	Chair	Children & Youth	Vertical & horizontal handgrips, foot harnesses, torso support, and pedal leveling system included.
Haverich Tricycles Haverich Ortho Sport, Inc.	Leg	3, 1F/2B	Chair	Children to Adults	All Haverich cycles are available with multiple combinations of accessories.
Modified Bicycle Specialty Customized Bicycles	Leg	2	Chair	Children to Adults	Available with vertical handlebars, abduction wedge, torso supports, and other accessories.
TMX Tricycle Triaid Inc.	Leg	3, 1F/2B	Chair	Children to Adults	
Haverich 27" Racing Tricycle Haverich Ortho Sports, Inc.	Leg	3, 1F/2B	Racing	Youth to Adults	All Haverich cycles are available with multiple combinations of accessories.
Rifton Large Chain Tricycle (E15) Rifton Equipment	Leg	3, 1F/2B	Chair	Youth to Adults	Vertical & horizontal handgrips, foot harnesses, torso support, and pedal leveling system included.
Adult Tricycle (PC 4747A) J A Preston	Leg	3, 1F/2B	Chair	Adults	
Adult Trike (4925E) Flaghouse	Leg	3, 1F/2B	Chair	Adults	
Counterpoint Presto Recumbent Bicycle Angle Lake Cyclery	Leg	2	Recumbent	Adult	
Terrier Duo Triaid Inc	Leg with hand-opposed	3, 1F/2B	Chair	Children & Youth	This model also available in leg power only (no handcrank).
Haverich Tricycle Model 20/16 Haverich Ortho Sport, Inc.	Leg or hand-opposed	3, 1F/2B	Chair	Children to Adults	All Haverich cycles are available with multiple combinations of accessories.
Hand Propelled Trike Anthony Bros. Manufacturing	Hand-opposed	3, 1F/2B	Recumbent	Children	
Mini Hand Propelled Tricycle Triaid Inc	Hand-opposed	3, 1F/2B	Chair	Children	For small children approximately 3 to 6 years old.
Hand-Drive Tricycle (PC 4756H) J A Preston	Hand-opposed	3, 1F/2B	Chair	Children	Abduction wedge, hip control belt, and adjustable seat standard.
Rifton Small Hand-Driven Tricycle (E11S, E11R) Rifton Equipment	Hand-opposed	3, 1F/2B	Chair	Children	Foot harnesses included. Also available with revolving foot pedals (E11R).
Mini HandPed Trike (6299E) Flaghouse	Hand-opposed	3, 1F/2B	Chair	Children	
Hand Drive Mobility Aid Tricycle Consumer Care Products, Inc.	Hand-opposed	3, 1F/2B	Chair	Children	Vertical handgrips, hip control belt, and foot harnesses for corresponding leg motion with hand pedal standard.
Standard Hand Propelled Tricycle Triaid Inc	Hand-opposed	3, 1F/2B	Chair	Children & Youth	For children approximately 5 to 11 years old.
Standard HandPed Trike (6557E) Flaghouse	Hand-opposed	3, 1F/2B	Chair	Children & Youth	

Model/Manufacturer	Power Input	Wheels/ Config.	Rider Position	User Groups	Comments
Freedom Specialties Cycle Freedom Specialties, Inc.	Hand-opposed	3, 1F/2B	Recumbent	Children to Adults	Includes a wheelchair hitch.
Large HandPed Trike (6149E) Flaghouse	Hand-opposed	3, 1F/2B	Chair	Youth	
Rifton Medium Hand-Driven Tricycle (E13) Rifton Equipment	Hand-opposed	3, 1F/2B	Chair	Youth	Foot harnesses included.
Large Hand Propelled Tricycle Triaid Inc	Hand-opposed	3, 1F/2B	Chair	Youth	For youth approximately 11 to 16 years old.
Haverich Tricycle BA Haverich Ortho Sport, Inc.	Hand-opposed	3, 1F/2B	Chair	Youth & Adults	All Haverich cycles are available with multiple combinations of accessories.
Palmer Handcycle Palmer Industries	Hand-opposed	3, 1F/2B	Chair	Youth & Adults	
Quantum Leap Quantum Leap	Hand-opposed	3, 1F/2B	Chair	Youth & Adults	Designed for on and off-road terrain.
Adult Hand Propelled Tricycle Triaid Inc.	Hand-opposed	3, 1F/2B	Chair	Adults	
Patroni Armcycle Patroni Armcycles	Hand-opposed or together	3, 2F/1B	Recumbent	Children to Adults	Allows pedal action away from or towards the rider.
The Varna Varna Bicycles	Hand-opposed or together	3, 2F/1B	Recumbent	Adults	Rear wheel drive racing cycle.
MACH 3 Quickie Designs/Shadow Products	Hand-together	3, 1F/2B	Chair	Children to Adults	Contact manufacturer for pediatric sized cycle information.
Freedom Ryder Bnke International/American Wheelsports	Hand-together	3, 1F/2B	Recumbent	Youth & Adults	May be used in competitive cycling events.
Handbike (TM) New Dimensions Design	Hand-together	2, 1F/1B & 2 middle	Recumbent	Youth & Adults	Two-wheel design with 2 casters that fold down under the rider's seat.
Pro-Cycle (TM) Top End by Action	Hand-together	3, 1F/2B	Chair	Children to Adults	Custom built for pediatric and adults and for persons with any disability, including quadriplegics.
The Hornet Grow-Cycle T-Wheeler, Inc.	Hand-push/ pull	3, 1F/2B	Chair	Children to Adults	
TheraPlay Irish Mail (PLP 362-403) PCA Industries	Hand-push/ pull	4, 2F/2B	Recumbent	Children	
Rock N' Roll Cycle Rock N' Roll Cycles	Hand-push/ pull	3, 1F/2B	Chair	Children & Youth	
TRI KING Tri King Corp	Hand-push/ pull	3, 2F/1B	Chair	Children to Adults	Uses any armstroke for continuous, high torque power.
TheraPlay Adult Irish Mail (PLP 382-603) PCA Industries	Hand-push/ pull	4, 2F/2B	Chair	Children to Adults	Rider must be able to maintain legs on front crossbar.
The Hornet Mountain-Cycle T-Wheeler, Inc.	Hand-push/ pull	3, 1F/2B	Chair	Youth & Adults	
The Hornet Standard T-Wheeler, Inc.	Hand-push/ pull	3, 1F/2B	Chair	Youth & Adults	With mountain bike tires for on and off-road riding.
Thunder Trike A.T.'s Freedom Factory	Hand-push/pull	3, 2F/1B	Recumbent	Adults	Multi-terrain capability; rear wheel drive.
Haverich 2-Wheeler Tandem 20" Haverich Ortho Sport, Inc.	Tandem - Leg	2	Chair	Youth & Adults	
Haverich 3-Wheeler Tandem 20" & 26" Haverich Ortho Sport, Inc.	Tandem - Leg	3, 1F/2B	Chair	Youth & Adults	
Counterpoint Opus IV Tandem Angle Lake Cyclery	Tandem - Leg	2	1 Recumbent/ 1 Racing	Adult	

Allyn Air Seat
18 Millstream Road, Woodstock, NY 12498. 914/679-2051.
- Bicycle Air Seat

American Wheelsports
c/o Steve Ackerman, 721 N. Taft Hill Road, Ft. Collins, CO 80521. 303/221-4290.
- Freedom Ryder distributor

Angle Lake Cyclery
20840 Pacific Hwy South, Seattle, WA 98188. 206/878-7457.
- Counterpoint Opus IV Semi-Recumbent Tandem
- Counterpoint Presto Recumbent Bicycle
- Presto Triad Recumbent Tricycles (available fall 1993)
- Angletech Custom Trikes

Anthony Brothers Manufacturing
1945 South Rancho Santa Fe Road, San Marcos, CA 92069-5195. 619/744-4763, 619/744-2994 Fax.
- Lo-Boy Trike

A.T.'s Freedom Factory
PO Box 641473, San Jose, CA 95164. 408/259-1122, 408/259-8425.
- *Thunder Trike*

Brike International
20589 S.W. Elkhorn Court, Tualatin, OR 97062. 800/800-5828.
- *Freedom Ryder*

C D Denison Orthopaedic Appliance Corp
220 W 28th Street, Baltimore, MD 21211. 410/235-9645.
- Child Foot Pedal Attachment
- Child Tricycle Back Support

Consumer Care Products Inc
PO Box 684, 810 N. Water Street, Sheboygan, WI 53082. 414/459-8353.
- Hand Drive Mobility Aid Cycle
- Mobility Aid Cycle
- Foot Harnesses
- Upper Trunk Support
- Abduction Pad
- Pedal Blocks
- Lower Trunk Positioning Belt
- Hand/Wrist Straps
- Seat Cushion
- Pedal Leveling System
- Universal Upper Trunk Support

Danmar Products, Inc.
221 Jackson Industrial Drive, Ann Arbor, MI 48103. 800/783-1998; 313/761-1990.
- Hard Shell Helmet (#9821)
- Hard Shell Helmet with Face Guard (#9822)
- Hard Shell Helmet with Face Bar (#9824)
- Rx Rider (#5025)

Equipment Shop
PO Box 33, Bedford, MA 01730. 617/275-7681.
- Cycle Back Support (ES-950)
- Foot Pedal Attachments (ES-975)
- Tricycle Pommel (ES-925)
- Upright Tricycle Handlebars (ES-900)

Flaghouse
150 North MacQuesten Parkway, Mt. Vernon, NY 10011. 914/699-1900; 800/221-5185.
- *Handped Trikes*
  - *Mini* (6299E)
  - *Standard* (6557E)
  - *Large* (6149E)
- *Mobility Trikes*
  - *Standard* (6459E)
  - *Deluxe* (6460E)
  - *Hand Driven* (6851E)
- Upper Trunk Support (6461E)
- Foot Harness (6463E)
- Lower Back Restraining Belt (6464E)
- Hand-Wrist Straps (6465E)
- *Lo-Boy Trikes*
  - *Low Boy Pedal Trike* (9606E)
  - Accessory Sets (9747E, 9687E)
- *Hand Propelled Trike* (9607E)
- *Adult Trike* (4925E)
- Vinyl Foam Protective Helmet (1237E-1239E)
- Soft Grown Leather Helmet
- Adapta Helmet (4093E)
- Bell Bike Helmet: Child Street Rider (7405E)
- Foot Harness (155E)
- Upright Handlebars (5872E)
- Pommel (5873E)
- Trike Back Support (5874E)
- Foot Pedal Attachments (5875E)
- Bench Seat (2745E)
- Slip-Over Seat Cushion (2714E)
- Lateral Torso Support Brace (Saf-T Trikes) (2929E)
- Foot Support Blocks for Saf-T Trikes (2930E)

Freedom Specialties Inc
Box 83, Cleghorn, IA 51014. 712/436-2666.
- *Freedom Cycle*

G E Miller Inc
540 Nepperhan Ave, Yonkers, NY 10701. 914/969-4036, 800/431-2924.
- *Saf T Trike* (GJ 3599)
- *Irish Mail* (GJ 3600B)
- Child Foot Pedal Attachments
- Child Tricycle Handbars (GJ 3064B)
- Tricycle Torso Support (GJ 3604)
- Tricycle Back Support (GJ 3604C)

Haverich Ortho Sport, Inc.
67 Emerald Street, Keene, NH 03431. 712/436-2666.
- *Haverich 27" Racing Tricycle*
- *Haverich Tricycle BA*
- *Haverich Tricycle Model 20/16*
- *Haverich Tricycles*
- *Haverich Two-Wheeler Tandem 20"*
- *Haverich Three-Wheeler Tandem 20", 26"*
- Leg Harness (062)
- Standard Backrest with Padded Strap (020)
- Wraparound Backrest with Padded Strap (017)
- Shoulder Harness (039)
- Hip Pads (039)
- Home Trainer Pedal (060)
- Pedal with Toe Clip and Strap (011)
- Foot Rest with Leather Straps (013)
- Foot Rest with Velcro Straps (113)
- Foot Rest with Leg Guide (010)
- Foot Rest and Leg Guide with Velcro Straps (110)
- Cane/Crutch Holder (040/041)
- Arm Supports (002)
- Auxiliary Handlebar (056)
- Vertical Bar Ends (050)

J A Preston Corporation
A Bissell Healthcare Company, PO Box 89, Jackson, MI 49204-0089. 517/787-1600; 800/631-7277; 517/789-3333 Fax.
- *Adapted Trainer Bicycle* (PC 4748B)
- *Adapted Tricycle* (PC 4744B, PC 4745B)
- *Chain Drive Tricycle* (PC 4745B, PC 4744B)
- *Foot-Drive Tricycle* (PC 4756FA/B)
- *Hand-Drive Tricycle* (PC 4756HA/B)
- Adapta-Helmet (PC F8090)
- Body Supports (PC 4749)
- Hard Shell Helmet with Face Bar
- Special Pedals (PC 4749)
- Tricycle Foot Harnesses
- Tricycle Positioning Belt (PC 4756B)
- Tricycle Trunk Support (PC 4756TA)

Jay Medical, Ltd.
PO Box 18656, Boulder, CO 80308-8656. 303/442-5529, 800/648-8282.
- The Jay Protector™

New Dimensions Design
90127 W. Demming Road, Elmira, OR 97437. 503/935-3162.
- *Handbike™*

Palmer Industries
PO Box 707, Union Station, Endicott, NY 13760. 607/754-1954, 800/847-1304.
- *The Palmer Handcycle*
- Handcycle Cover
- Crutch Holders

Patroni Machine & Design
9005 Amherst Avenue, Margate, NJ 08402. 609/823-8121.
- *Patroni Armcycle*

PCA Industries Inc
5642 Natural Bridge, St Louis, MO 63120. 314/389-4140; 800/727-8180.
- *TheraPlay Adult Safe-T-Trike* (382-601)
- *TheraPlay Adult Irish Mail* (382-603)
- *Irish Mail* (362-403)
- Body/Torso Support (362-341)

Quantum Leap
974 Pinson Boulevard, Rockledge, FL 32955. 407/631-8703.
- *Quantum Leap*

Quickie Designs, Inc/Shadow Products
20264 84th Avenue South, Kent, WA 98032-1224. 206/872-0722; 800/342-1579; 206/872-0741 Fax
- *MACH-3*
- *CYCL-ONE*

Rifton Equipment
Route 213, PO Box 901, Rifton, NY 12471-0901. 914/658-3141; 800/777-4244; 914/658-8065 Fax.
- Rifton Large Chain Tricycle (E15)
- Rifton Medium Hand-Driven Tricycle (E13)
- Rifton Small Chain Tricycle (E14)
- Rifton Small Hand-Driven Tricycle (E11R, E11S)
- Rifton Tricycle (E12)

Rock N' Roll Fun Machines
3405 69th Drive, Lubbock, TX 79413. 806/795-9262; 800/654-9664.
- *Rock N' Roll Cycles*

Saratoga Access & Fitness Inc
PO Box 1427, Fort Collins, CO 80522-1427. 303/484-4010.
- *The Saratoga Cycle*

Sinties Scientific, Inc.
5616A South 122nd East Avenue, Tulsa, OK 74146-6913. 918/254-7395.
- *Power Trainer P/A*
- *Upper Body Power Trainer*

Specially Customized Bicycles
c/o John Van Note, PO Box 116, Englewood, FL 34295-0116. 813/475-6646.
- *Specially Customized Bicycles*

Top End by Action
4501-63rd Circle North, Pinellas Park, FL 34665. 813/522-8677, 800/532-8677, 813/522-1007 Fax.
- *The Pro-Cycle*

TRI KING CORPORATION
10 Drake Terrace, Prospect Heights, IL 60070. 708/537-6032.
- *TRI KING*

Triaid Rehabilitation Products
PO Box 1364, Cumberland, MD 21502. 301/759-3525.
- *Terrier Duo Trike*
- *TMX Tricycle*
  Imp Foot Propelled Tricycle
- *Mini-Hand Propelled Tricycle*
  Standard Hand Propelled Tricycle
  Large Hand Propelled Tricycle
  Adult Hand Propelled Tricycle

TRS, Inc. - Therapeutic Recreation Systems
Suite 3, 1280 28th Street, Boulder, CO 80303-1797. 800/621-8385; 303/444-4720.
- One Hand Dual Brake Lever distributor

T-Wheeler, Inc.
7467 Mission George Road, #16, Santee, CA 92071.
- *The Hornet Grow-Cycle*
- *The Hornet Mountain-Cycle*
- *The Hornet Standard*

Varna Bicycles
54 RR2, Gabriola Island, British Columbia VOR 1X0, Canada. 604/247-8379
- *The Varna*

Sports Organizations for Persons with Disabilities

National Handicapped Sports and Recreation Association, 451 Hungerford Drive, Suite 100, Rockville, MD 20850. 301/217-0960.

This is the largest sports organization in the United States for persons with disabilities. There are 86 local chapters and affiliates. The *Handicapped Sports Report* is a newsletter put out by NHS that lists the names, addresses, and phone numbers of its chapters and affiliates; gives results of recent sports events; highlights exceptional athletes with disabilities; and provides a calendar of upcoming clinics and competitions that it sponsers.

National Wheelchair Athletic Association, 3595 East Fountain Boulevard, Suite L-1, Colorado Springs, CO 80910. 719/574-1150.

The NWAA was founded in 1956 and is recognized by the US Olympic Committee. This organization hosts many sports programs for persons with disabilities including youth programs. Since its inception, the NWAA has been directed and developed by wheelchair athletes and wheelchair sports enthusiasts themselves. NWAA acts as the coordinating body for 11 regional sports organizations which sponsor sanctioned events at the local and regional level leading to the National Wheelchair Games.

Eastern Amputee Athletic Association, 2080 Ennabrock Road, North Bellmore, NY 11710. 516/826-8340.

National Amputee Summer Sports Association, Ltd., 215 West 92nd Street, Suite 15A, New York, NY 10025. 212/874-4138.

United States Cerebral Palsy Athletic Association, Inc., 23077 Greenfield Road, Suite 205, Southfield, MI 48075. 313/557-5070.

Virginia Wadsworth Wirtz Sports Program, Rehabilitation Institute of Chicago, 345 East Superior Street, Chicago, IL 60611. 312/908-4292.

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Cycling Associations

The following organizations are not specific to persons with disabilities, but to cycling in general. They may be able to provide further information on cycling events, maps of cycle routes, and cycling programs open to all interested persons.

American Bicycle Association, PO Box 718, Chandler, AZ 85244. 602/961-1903.

Founded in 1977, this organization has over 90,000 members and 350 local groups of individuals interested in off-road bicycle racing. It administers 20 national competitions each year, including the Grand Nationals each Thanksgiving weekend in Oklahoma City.

Bicycle Association of America, 1506 21st Street, NW, Washington, DC 20036. 202/332-6986.

This organization was founded in 1977 to promote bicycling for transportation and leisure, and to increase the quality and number of local bicycling programs. BF of A publishes *Pro Bike News* (monthly), *Pro Bike Directory* (biennially), and *Pro Bike Proceedings* (biennially).

Bikecentennial: The Bicycle Travel Association, PO Box 8308, Missoula, MT 59807. 406/721-1776.

Bikecentennial was founded to develop the 4450-mile TransAmerica Coast-to-Coast Bicycle Trail (inaugurated in 1976). Currently, it focusses its research on mapping of bicycle touring routes. *BikeReport is a magazine put out by this organization 9 times a year. It also publishes* Cyclists' Yellow Pages, a resources directory.

International Human Powered Vehicle Races (IHPVR), PO Box 51255 Indianapolis, IN 46251. 317/876-9478.

This organization sponsors an annual event consisting of racing events of differing distances with all competitors powering their own vehicles. At the 1992 IHPVR, wheelchair athletes dominated the arm-powered speed event - for the first time. The world speed record for 200 meters was broken three times, and the current record holder is a wheelchair user.

United States Cycling Federation (USCF), c/o USOC, 1750 E. Boulder, Colorado Springs, CO 80909. 719/578-4581.

USCF is the governing body of amateur cycling in the US, and supervises and controls all bicycle competitions. USCF sponsors national championships and conducts training camps and clinics. *Cycling USA* (monthly) is put out by USCF.

Cycle Tours. Cycle touring, or road trips, are increasing in popularity and frequency. Distance and terrain of these tours varies greatly, as does the skill of the participants in each. For information on local or national tours and annual cycling events, local bike shops may be contacted. Quite often these shops will distribute pamphlets and flyers for community cycle clubs, as well as nationally distributed magazines catering to cyclists. Interested cyclists with disabilities should not be discouraged that the cycle shop staff has never heard of hand cycles or that publications about cycling events do not mention the participation of persons with disabilities. The organizers of the event in question should be contacted to see about tour terrain, distance, and accessible facilities at the start or finish of the tour. If more cyclists with disabilities start to participate in such events, perhaps organizers will start to recognize this new generation of cyclists.

Sports Publications of Interest to Athletes with Disabilities

******Bicycle Guide*, 744 Roble Road, Suite 190, Allentown, PA 18103-9100. 215/266-6893. Contains features on cycling competitors, new product write-ups, product reviews, articles on national cycling events, a Master Dealer Guide of cycle shops organized by state, and an international Tour & Travel section. Monthly except for combined Jan/Feb issue. (ISSN 1055-7830)

******BICYCLING*, 33 E. Minor Street, Emmaus, PA 18098. 215/967-5171. Articles, product descriptions and evaluations, stories on cycling events around the world (not specific to persons with disabilities). Regular departments include training and fitness, health and nutrition, touring, and equipment. This magazine named hand cyclist David Cornelsen as the 1990 Cyclist of the Year. Monthly, except September. (ISSN 0006-2073.)

Disabled Outdoors Magazine. 5223 South Lorel Avenue, Chicago, IL 60638. 312/284-2206. Articles, product descriptions, accessible resort listings, and personal accounts pertaining to outdoor activities including fishing, hunting, boating, and camping. Quarterly.

Handicapped Sport Report. National Handicapped Sports, 1145-19th Street NW, Suite 717, Washington, DC 20036. Information about organizational activities such as ski and fitness programs, scheduled events and highlights, news from the organization's chapters.

Journal of Orthopaedic and Sports Physical Therapy. Dr. Gary L. Smidt, The University of Iowa, S-114, Westlawn, Iowa City, IA 52242. Research studies, case studies, commentaries, abstracts of current literature, book reviews, new products and opportunities for training.

Palaestra. Challenge Publications, Ltd., PO Box 508, Macomb, IL 61455. 309/833-1902. Articles on sports, recreation, and physical education for people with physical or developmental disabilities. Research applications, sport nutrition, audiovisual and book reviews, new products, personal training profiles, and a calendar of events are included.

Special Recreation Digest. 362 Koser Avenue, Iowa City, IA 52246-3038. 319/337-7578. Information on programs, services, publications, meetings, materials, and special recreation needs of people with disabilities. Quarterly.

New Mobility (Formerly *Spinal Network Extra*). PO Box 4162, Boulder, CO 80306. 800/338-5412; 303/449-5412. Articles and features, letters to the editor, sports news, and information about new books and upcoming events. Quarterly.

Sports 'n Spokes. Paralyzed Veterans of America, 5201 North 19th Avenue, Suite 111, Phoenix, AZ 85015. 602/246-9426. Wheelchair competitive sports and recreation. Bimonthly.

Vision (Formerly *SportsScoop*). USABA, 33 North Institute Street, Suite 105, Colorado Springs, CO 80903. 719/630-0422. News, announcements, and activities of the United States Association for Blind Athletes (USABA). Reports on local, regional, national, and international sports events and information for persons with visual impairments. Quarterly.

******Winning: Bicycling Illustrated*, 744 Roble Road, Suite 190, Allentown, PA 18103-9100. 215/266-6893. Contains columns, features on cycling competitors, international cycling competition results, and new product write-ups. Monthly except for combined Jan/Feb issue. (ISSN 1055-7830)

***** These periodicals not specific to alternative athletics for persons with disabilities.

Resources & Recommended Additional Reading

Bernhardt, D. B. (Ed.). (1985). *Recreation for the Disabled Child.* New York: Haworth Press.

Discusses mainstreaming of individuals with physical or mental disabilities into recreational activities. Describes therapeutic aspects of recreation, exercise and training for individuals with spinal cord injury, amputation, cerebral palsy, chronic pulmonary diseases, cardiac disease, diabetes and blindness. Discusses handicapped skiing, running, team sports, competitive sports, body image and physical activity, body image as psychosocial phenomenon, malleability of the body image and structuring a program. Includes book reviews and recreational equipment, programs, audiovisuals and publications. (NARIC call number R00980.)

Conner, M. (1992). Low Vision Bicycling. *Journal of Visual Impairment & Blindness*, 86 (2), 111-114.

This article considers bicycling as a means of transportation, not recreation, for selected individuals with low vision, and examines the skills needed to operate a bicycle in a safe and responsible manner. Includes evaluation of the abilities of a persons with low vision, central versus peripheral field loss, necessary equipment, problems confronting cyclists with low vision, night riding, route planning, auditory techniques, and basic visual skills associated with low vision cycling. Includes references. (NARIC call number J22097.)

Cooper, Rory A., Ph.D. (1989). An Arm-Powered Racing Bicycle. *Assistive Technology*, 1 (3), 71-74.

Describes an arm-powered racing bicycle, its features, performance, and relative advantages over tricycles. Also discusses use of cycles by persons with disabilities in triathlons for persons with disabilities and gives times achieved by two- and three-wheeled cycles. (NARIC call number J14129.)

Cornelsen, David A. (1991). The Wonderful World of Hand Cycling. *Sports 'n Spokes*, 17 (2), 10 - 12.

Written by one of the top handcyclists in the world, this article discusses hand cycles, hand cycling techniques, and training tips.

Decker, J. & Voege, D. (1992). Integrating Children with Attention Deficit Disorder with Hyperactivity into Youth Sport. *Palaestra*, 8 (4), 16-20.

Describes an approach for integrating children with attention deficit disorder with hyperactivity (ADHD) into organized youth sport activities. The first part reviews the behavioral and psychosocial characteristics of children with ADHD, explains how the behaviors exhibited by children with ADHD can inhibit them from successfully participating in youth sport activities, and describes some of the benefits of youth sport environments for these children. The second part describes the Youth Sport Participation Profile (YSPP), a tool for promoting the successful integration of children with ADHD into organized youth sport activities. The YSPP contains ten sections for describing a child's abilities and special needs. It allows parents and sports coaches to profile the spectrum of a child's behaviors and to plan appropriate strategies for including the child in the sports program. A copy of the YSPP is included. (NARIC call number J23227.)

DeLil, HolLynn. (1993). Hands-On Mobility. *Mainstream*, August, 16 - 20.

Describes various types of hand cycles and a brief history of some of the changes cycles for persons with mobility disabilities have undergone. Lists manufacturers of handcycles.

Gailey, R. S., Jr. (1992). Recreational Pursuits for Elders with Amputation", *Topics in Geriatric Rehabilitation*, 8 (1), 39-58.

National survey of the participation of older amputees in recreational activities. Questionnaires were completed by 1,214 individuals, of whom 552 were aged 50 years or older. With the exception of persons aged 80-89 years, most of the older amputees reported participating in recreational activities. Regardless of age, those who did participate maintained a weekly rate of activity that was similar to that of the total population of amputees. The most popular recreational activities among the older amputees were cycling, golf, swimming, fishing, walking, dancing, boating, and bowling. These activities are described along with suggestions for basic instruction and adaptive equipment. (NARIC call number J23211.)

Goodling, M. D. & Asken, M. J. (1986). Sport Psychology III: Techniques for Performance Enhancement and Competitive Stress Management. *Sports 'N Spokes*, 12 (3), 27-29.

Discusses some techniques to assist athletes in controlling competitive stress and enhancing athletic performance, in the context of sport psychology. These techniques include relaxation training, EMG biofeedback, imagery and visual-motor behavior reversal, and self-talk with negative thought stopping. Describes the effects of stress on the athlete. Includes 8 references. (NARIC call number J6812.)

Horvat, Michael & Aufsesser, Peter M. (1991). The Application of Cross-training Techniques for the Physically Disabled. *Clinical Kinesiology*, 45 (3), 18-23.

Discusses the benefits of cross-training for persons with physical disabilities including avoidance of injuries and the achievement of optimal fitness or motor performance. Guidelines for participation are outlined. Cross-training is defined and primary muscle groups identified for cycling, running, and swimming. References are provided. (NARIC call number J22169.)

Jackson, R. W. & Davis, G. M. (1983). Value of Sports and Recreation for the Physically Disabled. *Orthopedic Clinics of North America*, 14 (2), 301-315.

Provides a history of sports competition and recreation for disabled athletes. Describes various sporting events disabled athletes participate in, the importance of an equitable medical classification for competition, classification of visual impairment, limb disablement and neurologic disorders, the classification scheme of the International Stoke Mandeville Games Federation, the psychosocial and physiological benefits of exercise, methods of fitness assessment and testing for muscle strength, and results of research on the fitness status of disabled people and the response to training programs. Includes photographs and references. (NARIC call number J4271.)

Johnstone, K. S. & Perrin, J. C. S. (1991). Sports for the Handicapped Child. *Physical Medicine and Rehabilitation: State of the Art Reviews*, 5 (2), 331-350.

Article in a special issue on the rehabilitation management of children with physical disabilities. Discusses the participation of handicapped children in sports. Specific topics include the various types of individual and team sports, both recreational and competitive, in which children with disabilities can participate; classification systems for wheelchair sports competition; the role of the physician and physical therapist; conditioning and training; resources for seeking out sporting opportunities; wheelchairs and adaptive equipment for children; and injuries and risks in sports for disabled youth. (NARIC call number R05924.)

Kegel, B. (1985). "Physical Fitness Sports and Recreation for Those with Lower Limb Amputation or Impairment." *Journal of Rehabilitation Research and Development Clinical Supplement, 1.*

Presents sources of information on sports modified for individuals with lower limb amputations and describes adaptive procedures, prosthetic systems and assistive techniques, based primarily on personal experiences of sports enthusiasts who have undergone amputation. Provides an overview of each sport, features of the sport that may appeal to individuals with lower limb amputations, modifications made to sporting equipment, prostheses for various levels of physical activity and movement, and safety tips. Describes competitive sports for persons with amputation. Includes photographs of equipment and prostheses, a subject list of sports literature, and a directory of organizations and resources for each sport. (NARIC call number R01595.)

Kelley, J. D. & Frieden, L. (Eds.). (1989). "GO FOR IT! A Book on Sport and Recreation for Persons with Disabilities." Washington, DC: Harcourt Brace Jovanovich.
Book introduces readers to opportunities available in sports and recreation for people with disabilities. The book is directed mainly to people with physical and sensory disabilities and offers many activities unique to Americans. It is based on the premise that being involved in sports and recreational activities is essential to health, fitness, and psychological well-being of all people, and those with disabilities need same opportunities to participate. Activities included are team sports, individual sports, outdoor sports and recreation, aquatics, track and field, winter sports, dance, regional games, and fitness. (NARIC call number R06053; ISBN 0-15-306999-6.)

Kennedy, D. W., Austin, D. R. & Smith, R. W. (1987). "Special Recreation: Opportunities for Persons with Disabilities." New York: Saunders College Publishing.
Textbook on special (non-therapeutic) recreation services for persons with disabilities. The book covers the philosophical and historical foundations for special recreational services; provides useful facts, tips, and techniques for specific types of disabilities; program and facility planning; activities and successful programs in several special recreation areas: camping and wilderness experiences, the arts, and competitive sports; and community resources, legislation affecting community programs and services, and trends in community recreation for special populations. (NARIC call number R04257.)

Lindstrom, H. (1984). Sports and Disabled Alive and Well. *Rehabilitation World*, 8 (1-2), 12-16.
Provides an insider's view of the international movement to make competitive sports available to disabled persons. The author is a former athlete who became disabled. Describes the activities of the International Sports Organization for the Disabled and other organizations. Discusses a variety of issues related to sports as recreation and as rehabilitation. Available from Rehabilitation International USA, NY. (NARIC call number XJ3846.)

Paciorek, M. J. & Jones, J. A. (1989). *Sports and Recreation for the Disabled: A Resource Handbook*. Indianapolis: Benchmark Press, Inc.
Presents information on sports and recreation for people with disabilities. The book is structured to make it easy to retrieve information about activities and modifications in equipment. Detailed data are presented on all-terrain vehicles, cycling, horseback riding, martial arts, motor scooter, road racing, roller skating, skiing, snowmobiling, swimming, table tennis, tennis, water skiing, and more. The six appendices include listings of lightweight wheelchair manufacturers, sports organizations, national handicapped sports and recreation association chapters, and national wheelchair athletic association chapters. (NARIC call number R05809; ISBN 0-936157-31-1.)

Radocy, B. (1987). Upper Extremity Prosthetics: Considerations and Designs for Sports and Recreation. *Clinical Prosthetics and Orthotics*, 11 (3), 131-153.
A discussion and description of numerous upper-extremity prostheses suitable for sports and recreation. Among the activities addressed are: weightlifting, archery, basketball, soccer, volleyball, football, bicycling, tricycling, motorcycling, canoeing, kayaking, dance, floor exercise and gymnastics, tumbling, fishing, golf, shooting, hockey, mountaineering, music, photography, sailing, snow skiing, swimming, water-skiing, and wind surfing. The author describes devices suitable for each activity. (NARIC call number J07981.)

Riggen, K. & Ulrich, D. (1993). The Effects of Sport Participation on Individuals with Mental Retardation. *Adapted Physical Activity Quarterly*, 10 (1), 42-51.
Study compares the benefits for persons with mental retardation participating in the Special Olympics and in the Unified Special Olympics. Three groups of adult men with mental retardation comprised the test subjects who would be evaluated for improvements in self perception and physical abilities. Two groups participated in each of the Olympic Basketball programs (traditional and unified), and the control group was not in a sport program. Pre- and post-test measurements were taken with the Perceived Competence Scale for Children for self-perception. Results reveal significant positive differences in self perception and an increase of ability for the Olympic programs compared to no sport participation. (NARIC call number J23560.)

Riley, R. (1987). Amputee Athlete. *Clinical Prosthetics and Orthotics*, 11 (3), 109-113.
A discussion of athletic competition among amputees and the kinds of support prosthetists provide them. Two products that alleviate chafing and friction pain are discussed. Organizations promoting athletic competition among amputees are listed. The author concludes by saying that prosthetics should be designed to accommodate athletic competition and that sports prosthetics should be recognized as a viable specialty. (NARIC call number XJ07984.)

Robbins, S. (1989). Pedal Power Revisited. *Sports 'N Spokes*, 15 (3), 32-36.
A survey of handcycle manufacturers and their products. The listing is alphabetical by company name, and includes the manufacturer's address, phone number, description and photograph of the product, available options, and price range. The products include two-wheeled and three-wheeled cycles, cycles for adults and for children. Most are powered by hand-pedaling action, and one is powered by a rowing action. (NARIC call number J15043.)

Shephard, R. J. (1991). Benefits of Sport and Physical Activity for the Disabled: Implications for the Individual and for Society. *Scandinavian Journal of Rehabilitation Medicine*, 23 (2), 51-59.
Paper examines potential benefits of sports and physical activity for people with physical disabilities such as issues of terminology about sport and physical activity; participation patterns of people without disabilities; sports for people with disabilities; psychological benefits of physical activity; social benefits of sports and physical activity; health benefits of physical activity; functional benefits from physical activity; and economic benefits from physical activity. (NARIC call number J20642.)

Winston, L. (1985). *Recreation and Sports: An Accent Guide*. Illinois: Cheever Publishing.
Guide to the possibilities available to people with disabilities concerning sports and recreation, and to special products and devices available for different sports and activities. Gives examples of what some people with disabilities are doing, and provides specific information on travel, camping, sports, relaxation, and enjoyment. Lists organizations and references. (NARIC call number R01396.)

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